THE FRESHWATER AND BRACKISH-WATER DIATOMS OF PENIKESE ISLAND, MASSACHUSETTS: 1923 and 1973

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In 1873 Penikese Island was the site of the establishment by Louis Agassiz of the Anderson School of Natural History — the spiritual forerunner of the Marine Biological Laboratory at Woods Hole and the impetus for significant changes in the conduct of American science (Lurie, 1974). The flora and fauna of the island were investigated in that year in keeping with the Agassizian tradition of studying "nature, not books." Since then, in 1923 and 1947, the flora and fauna have been reinvestigated in commemoration of Agassiz' original effort. In 1973 a centennial commemoration was held at the Marine Biological Laboratory; this report on the diatom flora is part of the survey of the island conducted at that time.

The only previous investigation of the diatom flora of Penikese was conducted by Conger (1924) in the summer of 1923 during the fiftieth anniversary of the Anderson School's founding. His survey of the freshwater, brackish, and marine habitats listed 96 diatom species and varieties of which over 60% were recorded from euhaline Penikese Harbor. This 1973 reinvestigation was confined to the freshwater and brackish habitats. All ponds and the marsh sampled by Conger were reexamined in 1973 except Dry Pond which had become extinct. Three additional habitats were sampled for their diatoms for the first time: the northernmost of the reservoirs, Leper Pond, and Zinn's Pond. The locations and descriptions of the ponds and the marsh have been presented by Croasdale (1935, 1948).

METHODS

Penikese Island (41° 27′ N, 70° 55′ W) is part of the Elizabeth Islands chain, which forms the southern boundary of Buzzards Bay, Massachusetts, U.S.A. On 16 August 1973 the ponds and the marsh of the island were sampled for their planktonic, epilithic, epipelic, and epiphytic diatom assemblages. Samples were prepared for microscopic examination using the acid-dichromate-Hyrax procedure of Patrick and Reimer (1966). Taxonomic determinations were made using both brightfield oil-immersion optics with parallel and oblique illumination and phase-contrast optics at a magnification of 1000×. Also, the light microscope structure of some individuals, especially small ones in problematical taxa, was pursued using the scanning electron microscope to facilitate the determinations. Primarily the common diatoms, those having greater than about 1% relative abundance in a sample, have been determined in this survey. All samples and slides have been deposited in the Hellerman Diatom Herbarium (HDSM) at Southeastern Massachusetts University under the reference numbers *HDSM 722–748*.

Selected physicochemical measurements of each pond's surface water were made at the time of the survey and were provided to me by Dr. Peter H. Rich of the University of Connecticut. His water samples were collected near the center of each pond between late-morning and mid-afternoon; their temperature (Whitney Underwater Thermometer Model TC-5C), dissolved oxygen concentration (unmodified Winkler procedure), pH (analytical means unknown), and specific conductance (Yellow Springs Conductivity Cell Model 3402 and Bridge Model 31) were measured. Light penetration was estimated with a Secchi disc.

RESULTS AND DISCUSSION

Pond water quality

Selected measurements of the physicochemical characteristics of the ponds taken at the time of the survey are presented in Table 1. Generally the ponds were warm (21–27° C), slightly alkaline and turbid, with low dissolved oxygen concentrations (2–4 mg $O_2 \cdot l^{-1}$) and low oxygen percent saturations (*ca.* 20–50%). Typha Pond was exceptional in being supersaturated (*ca.* 125%) with oxygen. Based on my own past observations South Pond is characteristically mesohaline, as the specific conductance measurement indicates, and Tub Pond, although not measured, is usually at least as saline, being at a lower elevation and closer to the exposed coast. All the other ponds had a relatively low specific conductance and were freshwater or possibly slightly oligohaline. The Marsh had about twice the specific conductance of the other freshwater habitats.

The flora

Seventy-nine diatom species and subspecific taxa were determined from the ponds during this survey (Table 2). Although sam-

Table 1. **Physicochemical characteristics of the surface waters of Penikese Island ponds on 16 August 1973.**

Locations	*Temperature* (°C)	*Secchi Depth* (cm)	*Specific Conductance* (umhos· cm^{-1})	pH	*Dissolved Oxygen* (mg $O_2 \cdot l^{-1}$)
Reservoir	23.1	80	363	—	2.0
The Marsh	24.9	15	607	—	4.0
Zinn's Pond	26.3	15	219	—	4.0
Leper Pond	27.4	30	245	7.8	4.3
Tern Pond	24.4	10	355	7.8	3.5
Typha Pond	21.4	13	339	7.8	11.4
South Pond	21.3	40	9,716	7.0	3.2
Tub Pond	—	—	—	—	—

ples of several microhabitats within each pond were collected and examined separately, qualitative differentiation of these microhabitats based on the diatoms was not usually apparent, and consequently the presentation in Table 2 segregates the taxa solely by their larger scale distribution among the ponds. The surveys of 1923 and 1973 have 18 species in common, but only 9 of them were recorded from the same ponds. Neither survey attempted to deal quantitatively with the flora; however, a qualitative comparison of the common diatoms from the two surveys does reveal substantial differences.

Conger reported from brackish South and Tub Ponds several species which are frequent along the southern New England coast, but he noted particularly that *Caloneis oregonica* (Ehr.) Patr. (synonym: *Navicula formosa* Greg.) in South Pond and *Navicula peregrina* in Tub Pond were predominant. During the recent survey of these two species only *N. peregrina* was found, but in South Pond and it was not abundant. In 1973 South Pond contained also large populations of *Plagiotropis lepidoptera,* which was recorded by Conger from both ponds, *Amphora coffeiformis* including both var. *coffeiformis* and var. *perpusilla, Nitzschia frustulum* var. *subsalina,* and *N. fonticola.* Tub Pond was dominated by the same two varieties of *Amphora coffeiformis* as were found in South Pond. Species of *Amphora* and *Nitzschia* were not recorded from either pond in 1923, but they constituted major components of the flora of each during this survey. The collection of *Coscinodiscus excentricus,* *Paralia sulcata*, and *Stauroneis amphioxys* occurred also during both surveys from these ponds.

Typha Pond in 1923 had an abundant population of *Navicula elegans*, but in 1973 this species was rare in an assemblage dominated by *Nitzschia kutzingiana*. Both surveys of this pond found *Navicula cuspidata*, *N. rhynchocephala*, *N. capitata* var. *hungarica* (synonym: *N. nanella* Conger) and *Stauroneis phoenicenteron* f. *gracilis*.

The Marsh contained large populations of *Gomphonema parvulum*, *Navicula calida*, *N. cuspidata*, *Nitzschia palea*, and *Pinnularia viridis* in 1973. It was dry during Conger's visit but he did record *Navicula elegans* from its mud; this was the only species common to our lists from The Marsh.

Tern, Leper, and Zinn's Ponds, which are clustered just north of the remains of the leper village, were dominated by *Nitzschia kutzingiana*. Also, Leper and Zinn's Ponds supported large populations of *Nitzschia obtusa* var. *scalpelliformis* f. *nipponica*, while Tern Pond contained mostly populations of *Synedra pulchella* var. *lacerata*, *Gomphonema parvulum*, and *Stauroneis phoenicenteron* f. *gracilis*. None of the six species reported in 1923 from Tern Pond was found in it during this survey.

The northernmost reservoir on the hilltop at the southern end of the island was sampled for the first time during this survey and contained predominantly planktonic populations of *Nitzschia kutzingiana* and *Navicula cuspidata*.

A survey of the diatom flora of Penikese was not conducted in 1947 during the "seventy-fifth" anniversary of the Anderson School's founding because the floristic changes were expected to be minimal over only twenty-five years. However, in the results of the two surveys which span 50 years major qualitative differences do exist. To what extent these differences are functions of the seasonally variable nature of the ponds and the succesional changes in the environment over the past few decades is unassessed. Conger's observations indicate he sampled the flora during a dry period in mid-summer, while in 1973 I found no indications of a drought. The successful identification of future changes in the diatom flora over ecological time spans will have to be linked to a quantiative analysis of the flora and its seasonal variability.

Table 2. **The distribution of diatom taxa on Penikese Island during the 1923 and 1973 surveys.** C = recorded only in 1923, E = recorded only in 1973, and B = recorded in both surveys. The harbor was not sampled in 1973.

Taxa	Tub Pond	South Pond	Typha Pond	Tern Pond	Leper Pond	Zinn's Pond	The Marsh	Reservoir	Harbor
COSCINODISCACEAE									
Melosira varians Ag.					E				
Paralia sulcata (Ehr.) Cl.		B					C		C
Cyclotella comta (Ehr.) Kütz.			C	C	E			E	
C. meneghiniana Kütz.						E	E		
C. striata (Kütz.) Grun.	E								
Coscinodiscus excentricus Ehr.	B	B							C
Thalassiosira decipiens (Grun. *ex* V.H.) Jørg.	E								
Hyalodiscus scoticus (Kütz.) Grun.	E						E		
ACTINODISCACEAE									
Actinoptychus senarius (Ehr.) Ehr.	E						C		C
CHAETOCERACEAE									
Chaetoceros decipiens Cl.		E							C
FRAGILARIACEAE									
Diatoma tenue var. *elongatum* Lyngb.			E						
Fragilaria vaucheriae (Kütz.) Peters.							E		
F. construens var. *venter* (Ehr.) Grun.		E				E	E	E	
Rhaphoneis minutissima Hust.	E								
R. surirella (Ehr.) Grun.	E								
Synedra fasciculata var. *truncata* (Grev.) Patr.		E							
S. pulchella var. *lacerata* Hust.			E	E	E		E		
Grammatophora serpentina (Ralfs) Ehr.	E								
Rhabdonema adriaticum Kütz.	E	C							C
EUNOTIACEAE									
Eunotia curvata (Kütz.) Lagerst.	E								
E. pectinalis var. *minor* (Kütz.) Rabh.	E				E		E		
ACHNANTHACEAE									
Achnanthes hauckiana Grun.							E		
A. lanceolata (Bréb.) Grun.							E		
A. minutissima Kütz.			E						
A. wellsiae Reim.		E							
Cocconeis dirupta Greg.	E								
C. pellucida Grun.							E		
C. peltoides Hust.	E		E						
C. placentula var. *euglypta* (Ehr.) Cl.	E			E				E	

Table 2. Continued.

Taxa	Tub Pond	South Pond	Typha Pond	Tern Pond	Leper Pond	Zinn's Pond	The Marsh	Reservoir	Harbor
C. placentula var. *lineata* (Ehr.) V.H.		E			E				
C. scutellum Ehr. var. *scutellum*	E		E		E		E		C
C. scutellum var. *parva* Grun. *ex* Cl.	E	E		E			E		
C. Stauroneiformis (V.H.) Okuno	E								
NAVICULACEAE									
Navicula arenaria Donk.	E	E							
N. calida Hend.	E						E		
N. capitata var. *hungarica* (Grun.) Ross			B	E			E		
N. crucicula (W. Sm.) Donk.	E	E							
N. cryptocephala var. *veneta* (Kütz.)Rabh.			E				E	E	
N. cuspidata Kütz.			B				E	E	
N. elegans W. Sm.			B				B	E	
N. gregaria Donk.	E	E	E				E		
N. lagerheimii var. *intermedia* Hust.	E								
N. mutica Kütz.	E				E				
N. pelliculosa (Bréb. *ex* Kütz.) Hilse			E	E	E	E	E		
N. peregrina (Ehr.) Kütz.	C	B					C		
N. pupula Kütz. var. *pupula*			E						
N. pupula var. *elliptica* Hust.					E				
N. pusilla W. Sm.							E		
N. pygmaea Kütz.	E	E	E						
N. rhynchocephala Kütz.		E	B				E		
N. salinarum Grun.	E	E					E		
N. salinicola Hust.	E	E							
Stauroneis amphioxys Greg.		B	C						
S. phoenicenteron f. *gracilis* (Ehr.) Hust.	E		B	E	E	E	E		
S. producta Grun.	E		E	E			E	E	
Caloneis bacillum (Grun.) Cl.			E	E			E		
C. lenzii Krass.			E						
Pinnularia borealis Ehr.			C		E	E			
P. obscura Krass.	E	E		E	E	E	E		
P. subcapitata Greg. var. *subcapitata*	E		E		E	E	E	E	
P. subcapitata var. *hybrida* (Grun.) Freng.	E	E	E		E	E	E	E	
P. viridis (Nitz.) Ehr.	E		E	C	E	E	E		
Entomoneis pulchra (J.W. Bail.) Reim.		E							
Plagiotropis lepidoptera (Cl.) Reim.	B	B							
GOMPHONEMACEAE									
Gomphonema parvulum Kütz.	E		E	E	E	E	E	E	

Table 2. Continued.

Taxa	Tub Pond	South Pond	Typha Pond	Tern Pond	Leper Pond	Zinn's Pond	The Marsh	Reservoir	Harbor
CYMBELLACEAE									
Amphora coffeiformis (Ag.) Kütz. var. *coffeiformis*	E	E							
Amphora coffeiformis var. *perpusilla* (Grun.) Cl.	E	E							
BACILLARIACEAE									
Nitzschia bilobata var. *minor* Grun.	E								
N. fonticola Grun.		E	E				E		
N. frustulum (Kütz.) Grun. var. *frustulum*						E			
N. frustulum var. *perminuta* Grun.		E	C				E	E	
N. frustulum var. *subsalina* Hust.		E							
N. kutzingiana Hilse	E		E	E	E	E	E	E	
N. lanceolata var. *minima* Grun.			E						
N. obtusa var. *scalpelliformis* f. *nipponica* Negoro	E	E	E	E	E	E	E	E	
N. palea (Kütz.) W. Sm.	E			E	E	E	E	E	
N. parvula Lewis						E			
N. subtilis var. *paleacea* Grun.			E	E	E	E	E	E	
Hantzschia amphioxys (Ehr.) Grun.	E					E	E		

NOTES ON SELECTED TAXA

Navicula capitata var. **hungarica** (Grun.) Ross Figures 1–3

Distribution: Typha Pond (*HDSM 727, 728*), Tern Pond (*HDSM 733, 734, 736*)), The Marsh (*HDSM 743, 744*)

Conger (1924) described a single new species from his investigation of the island — *Navicula nanella*, which he found in Typha Pond. He noted its resemblance to Cleve's (1895) description of *Navicula hungarica* Grun. but described it as a new species because of 1) differences in his interpretation of the "strongly marked striae" of Cleve, 2) the absence of a strongly dilated central region of the valve, which he mistakenly said Cleve figured, and 3) his contention, for which I can find no basis in Cleve, that Cleve implied "that the costae are striate" while in *N. nanella* they were not.

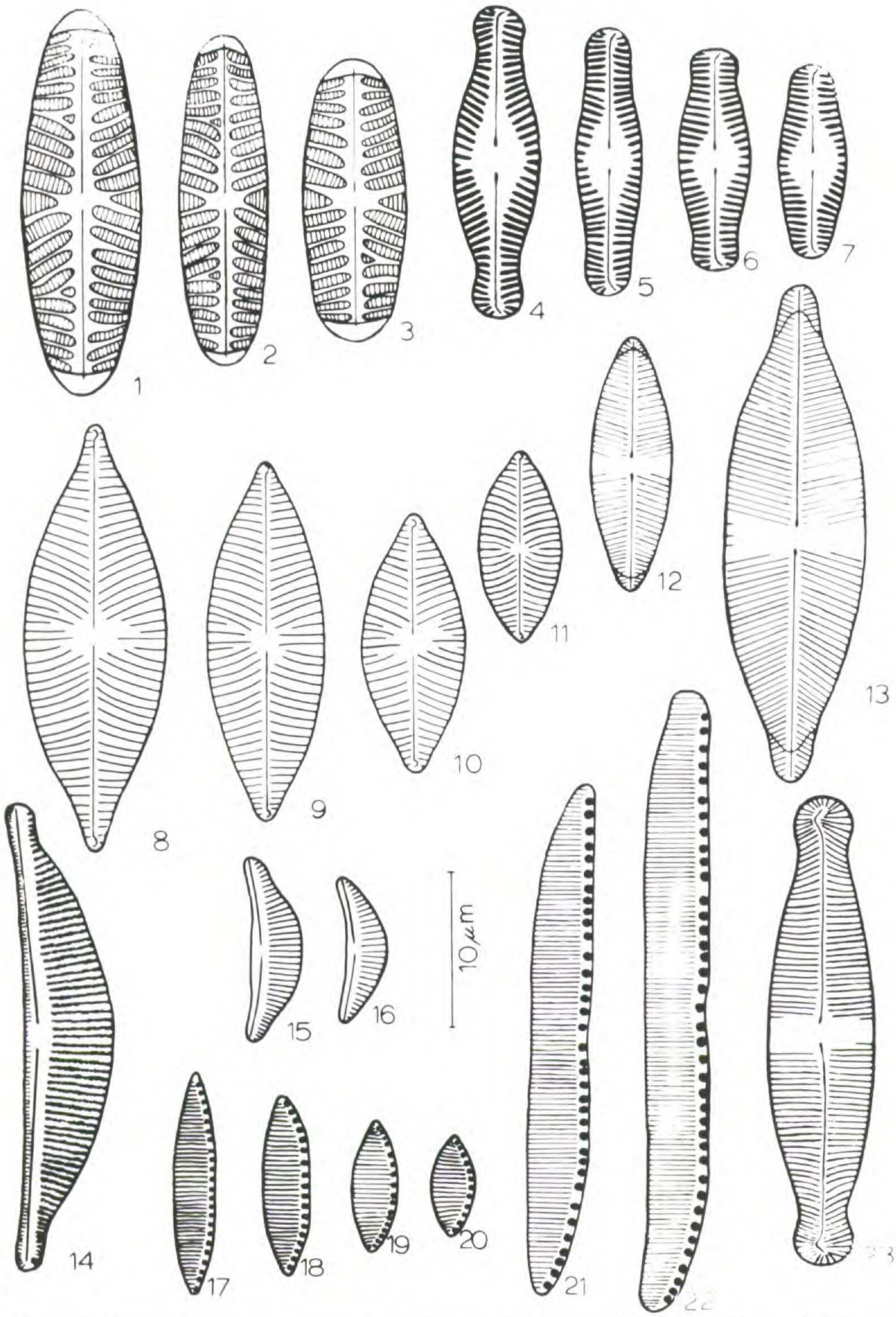
My observations on the Typha Pond population using both light and scanning electron microscopy indicate that the "strongly marked terminal striae" of most authors is due to an internal, apically widened and thickened costa which occurs either at the junction of the valve face and mantle or just apical to that junction and consequently on the mantle. The interpretation of this internal thickening as a costa and not as a transapically expanded terminal nodule is supported by two different sets of observations. First, the terminal pore of the raphe on the valve face ends proximally to the thickening and between the two terminal striae, which may be shorter than other striae due to the presence of a terminal nodule. In the light microscope some views of the valve suggest the raphe extends into the thickening but this view is produced by the curvature of the valve resulting in the superimposition of this thickening, which is at the junction or on the mantle, and the raphe, which is "above" it on the valve face. Different viewing angles could either accentuate or diminish this superimposition. The costa resembles a pseudoseptum, but it is nonmembranous and does not project far from the valve. Conger (1924) illustrated this costa based on girdle views of his material but its projection in his illustration appears exaggerated. Second, on the valve mantle apical to the thickening there are two lineolate (*ca.* 4 punctae/μm) striae, which are continuous across the pervalvar axis and which have punctae only 20–50% as long as those on the valve face. In favorable girdle views in the light microscope their presence is indicated although their interpretation as striae is not apparent. These mantle striae have been described previously using the transmission electron microscope in *Navicula hungarica* (Helmcke and Kreiger, 1953, taf. 70) and *N. hungarica* var. *capitata* (Helmcke et al., 1974, pl. 878). The presence of striae on both sides of this thickening supports the idea that it is a costa which has undergone additional thickening and apical widening compared to those of the valve face. Other non-Penikese populations of *N. capitata* var. *hungarica* that I have examined show the same junctional costae and apical mantle striae. Additionally, none of the costae in the Penikese populations or other populations of var. *hungarica* that I have examined contains punctae or striae.

The only morphological basis for the separation of the Penikese population from *Navicula capitata* var. *hungarica* that merits additional consideration here is valve shape. However, Conger's description of *N. nanella* conforms in this respect to that of both *N.*

oestrupi f. *elliptica* Schulz and *N. hungarica* var. *genuina* f. *elliptica* (Schulz) Cleve-Euler. VanLandingham (1975) has placed each of these latter names in synonymy with *N. capitata* var. *hungarica* (Grun.) Ross, but confirmation of his decisions regarding these names should be based on an examination of the respective types, and this I have not done. The description of the valve shape of var. *hungarica* has been consistent in the literature: valves linear-lanceolate to rhombic-lanceolate with broadly rounded to obtuse ends (Cleve, 1895; Hustedt, 1930; Patrick and Reimer, 1966). Conger's characterization of *N. nanella* as "elliptical with broad obtuse ends" is consistent with this.

I have seen only photographs sent to me by Dr. Conger of the type of *Navicula nanella*, but I am certain nevertheless that we have observed the same population from Typha Pond. His taxon carrying the specific epithet *nanella* has been recorded in no survey other than the 1923 one of Penikese; presumably, populations which have been observed and conformed to the description of *nanella* have been determined to be confined within the description of *N. hungarica* or its synonyms. Also, about three-quarters of all individuals in the Penikese population display the "défauts réguliers" of Voigt (1943), in this case, symmetrically disposed, disjunct striae segments on the valve face, usually on the same side of the raphe at opposite ends of the valve (Figures 1 and 2). Conger illustrated this same phenomenon in his original description of *nanella* and his photographs of the type show the same irregularity. Additionally, Helmcke et al. (1974) point out that in *N. capitata* var. *hungarica* "misarrangement of the loculi occasionally occurs." Based upon all the above considerations, *Navicula nanella* Conger falls within the range of morphological variation exhibited by *N. capitata* var. *hungarica* (Grun.) Ross, and I do not consider it a distinct species.

Finally, Patrick and Freese (1960) described a new variety from Alaska which displays the same kind of "défauts réguliers" — *Navicula hungarica* var. *arctica*. A survey of populations of var. *arctica* at the Academy of Natural Sciences of Philadelphia (PH: *GC'8251C & GC'8241A*) indicates that this irregularity is a general characteristic of this variety, at least in those samples. "Défauts réguliers" are observable in many different diatom species as anomalies, but in these closely related populations from Massachusetts and Alaska they are more the rule.



Figures 1–23. Selected Diatoms of Penikese Island, Mass. **1–3,** *Navicula capitata* var. *hungarica;* **4–7,** *Navicula calida;* **8–11,** *Navicula salinarum;* **12–13,** *Stauroneis producta;* **14,** *Amphora coffeiformis* var. *coffeiformis;* **15–16,** *Amphora coffeiformis* var. *perpusilla;* **17–20,** *Nitzschia frustulum* var. *subsalina;* **21–22,** *Nitzschia obtusa* var. *scalpelliformis* f. *nipponica;* **23,** *Caloneis lenzii.*

Navicula calida Hendey Figures 4–7

Distribution: The Marsh (*HDSM 741, 742*), Tub Pond (*HDSM 747*).

Hendey's (1964) original description and illustration of this species agree with that segment of the Penikese populations illustrated in Figure 4, except he indicated that frustule length was limited to 14–16 μm and Penikese individuals were frequently either larger or smaller than that. Among all populations I observed the following ranges in valve measurements: length (8–21 μm), breadth (4–6 μm), and striae (18–22 in 10 μm in the center to 22–26 in 10 μm at the ends). Smaller individuals have valve ends less constricted than what he indicted for *Navicula calida*. The smallest individuals in these populations (Figure 7) strongly resemble *N. justa* Hustedt (Hustedt, 1955), except *justa*'s valves are larger for the same shape (length: 14–18 μm; breadth: 5–6 μm) and its striae are a little finer than those of the Penikese individuals (24–26 in 10 μm). Also, Hustedt's illustration of *justa* indicates striae on the valve face apical to the terminal pore of the raphe; such striae are not observable in the light microscope in the Penikese populations. Hustedt reported *N. justa* "on mud from piles in (Beaufort, North Carolina) harbor," which is euhaline; the Penikese populations are from oligohaline to polyhaline habitats and are also epipelic. I have been unable to obtain samples of *N. justa* for comparison with *N. calida*, but based on the small magnitude of differences in frustule size, striae density and configuration, the similarity of the raphe systems and asymmetrical central areas, and the variability shown in the Penikese populations, I doubt the distinctness of these two nominal species.

Navicula salinarum Grun. Figures 8–11

Distribution: South Pond (*HDSM 722–726*), The Marsh (*HDSM 743*), Tub Pond (*HDSM 745–747*).

The larger individuals in these populations (Figure 8) conform to the general description of the species. Intermediate size individuals, ones around 20 μm long, approximate the description of *N. salinarum* f. *minima* Kolbe, except their striae are finer (18–20 in 10 μm as compared to 16–17 in 10 μm). But the smallest individuals (length: 12.5 μm; breadth: 5.5 μm; striae: 20 in 10 μm in the center to 24 in 10 μm at the ends) are not congruent with any of the described variants of *N. salinarum* or any other species of *Navicula* (Figure

11). The raphe systems and lineolate striae are the same in all size individuals as viewed in the scanning electron microscope. The central area is variable in both size and in the irregularity of the adjacent striae, and in the smallest individuals the central area may be vestigial. The full range of variation observed in these populations was: length (12.5–38 μm), breadth (5–13 μm), and striae (16–20 in 10 μm in the center to 18–24 in 10 μm at the ends).

Stauroneis producta Grun. Figures 12 and 13

Distribution: Typha Pond (*HDSM 727, 728*), Reservoir (*HDSM 729*), Tern Pond (*HDSM 732*), The Marsh (*HDSM 741–744*), Tub Pond (*HDSM 747*).

Hustedt (1959) gave a minimum valve length of 30 μm and minimum breadth of 8 μm for this species. The range in the Penikese populations was a length of 13.5–38.2 μm and a breadth of 4.5–10.2 μm. As the size of the individuals decreases there is a continuous reduction in the rostrateness of the valve ends, until in the smallest individuals the ends are very slightly produced or just rounded (Figure 12).

Amphora coffeiformis (Ag.) Kütz. var. **coffeiformis** and var. **perpusilla** (Grun.) Cl. Figures 14–16

Distribution: South Pond (*HDSM 722–726*), Tub Pond (*HDSM 745–747*).

In var. *coffeiformis* the dorsal striae of the valve in these populations varied from 19 in 10 μm (center) to 28 in 10 μm (ends); the ventral striae were about 40 in 10 μm. Also, the raphe is not in the center of the axial area but displaced toward the ventral striae and separated from the dorsal striae by a thick external ridge of silica running the entire length of the valve. Recognition of var. *perpusilla* in the light microscope is replete with uncertainty. Only the valve and frustule shape, the presence of a raphe and the general orientation and density of the dorsal striae can be seen. Its relationship to *A. coffeiformis* is not apparent. Under the scanning electron microscope, however, the ultrastructure of the striae, the position of the raphe and the elongated ridge of silica that runs dorsal to the raphe indicate its affinity. In the Penikese populations individuals of var. *perpusilla* were as small as 7.5 μm in length with dorsal striae around 30 in 10 μm. Although ventral striae are not resolvable in the light microscope, they are present at a density of 55–60 in 10 μm.

Nitzschia frustulum var. **subsalina** Hust. Figures 17–20
Distribution: South Pond (*HDSM 722–726*).

This variety was quite variable in the Penikese collections. Individuals ranged from 6.8–14.6 μm long to 3.0–3.3 μm broad with 14–18 fibulae (= keel punctae) in 10 μm and 32–36 striae in 10 μm. The striae were a little finer than the 29 in 10 μm that Hustedt (1930) originally indicated for var. *subsalina*. Aleem (1949) illustrated a population he described as "*Nitzschia frustulum* (Kütz.) Grun. var. ? (*cf.* var. *subsalina* Hust.)" which conforms to the Penikese populations except the striae are coarser (27–29 in 10 μm). The smallest individuals in the populations (Figure 20) agree with the description of *N. frustulum* var. *indica* Skvortz. (Skvortzow, 1935) except his individuals are not as broad (length: 5.0–8.5 μm; breadth: 2.0–2.5 μm; fibulae: 18 in 10 μm; striae: 30–35 in 10 μm). Also, Hohn and Hellerman (1966) described *N. barca* (length: 8.9 μm; breadth: 3.6 μm; fibulae: 17 in 10 μm; striae: 30 in 10 μm) which is not different from my Figure 19, except the striae are slightly coarser. I find the distinctness of all these taxa questionable.

Nitzschia obtusa var. **scalpelliformis**
f. **nipponica** Negoro Figures 21–22
Distribution: South Pond (*HDSM 722, 723*), Typha Pond (*HDSM 727, 728*), Reservoir (*HDSM 729*), Tern Pond (*HDSM 730, 731*), Leper Pond (*HDSM 733–736*), Zinn's Pond (*HDSM 737–739*), The Marsh (*HDSM 742, 743*), Tub Pond (*HDSM 747*).

Nitzschia obtusa var. *scalpelliformis* is a common diatom along the western Atlantic coast; however, forma *nipponica* Negoro (Negoro, 1944) is unreported from this region. This may be more an artifact of the general unavailability of Negoro's literature than the absence of the taxon from the area. The concept of var. *scalpelliformis* in the literature (Hustedt, 1930; Peragallo & Peragallo, 1897–1908; Van Heurck, 1880–1885) circumscribes a group of relatively large diatoms (60–110 μm long by 6–13 μm broad) with coarse fibulae (5–9 in 10 μm) and moderately dense striae (26–30 in 10 μm). The variation observed in the Penikese populations was: length (23–46 μm), breadth (4.0–4.5 μm), fibulae (9–11 in 10 μm) and striae (36 in 10 μm). Larger individuals have subrostrate ends (Figure 22) while smaller ones are more rounded but unilaterally attenuated at the ends (Figure 21). These Penikese individuals are quite comparable to f. *nipponica,* which was described as having a length of 17–40 μm, a breadth of 3–4 μm, 9-11 fibulae in 10 μm, and striae "resolved only with extreme difficulty" (Negoro, 1944). Manguin (1942, p. 155, pl. 4, fig. 82) illustrated an unnamed form of *N. clausii,* which is identical to my Figure 22, and he indicates its similarity to *N. obtusa* var. *scalpelliformis*.

Caloneis lenzii Krasske Figure 23
Distribution: Typha Pond (*HDSM 727, 728*)

This species which was originally described from South America (Krasske, 1951) is reported here for the first time in North America.

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